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Followness of Altcoins in the Dominance of Bitcoin: A Phase Analysis

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ABSTRACT

Due to the transparency, simplicity, and blockchain system, cryptocurrencies gained popularity in the modern world. This led to more use of cryptocurrencies for speculation and investment rather than a medium of exchange. It is crucial to analyse the nature of the crypto market before investing in such currencies. With this intention, the paper tried to know the extent of following (Followness) of altcoins to the bitcoin in the different dominance phases like High Dominance, Low Dominance, and Moderate Dominance. For this purpose, daily closing prices of the Bitcoin and five major altcoins (Ethereum, Litecoin, Namecoin, Doge, and Ripple) are collected for the last five years and analyse the relationship between bitcoin and altcoins. Pearson's correlation coefficient test is used to know the direction of the relationship, and Vector Error Correction Model is used to see the extent of the relation. In general, the empirical result of the study showed cointegration between bitcoin and Altcoin. It also depicted that Altcoin showed a high level of followness in the moderate dominance phase and low followness in the low dominance phase. The study developed a price estimation equation to predict the price of altcoins depending upon the price of bitcoin and its dominance in the crypto market. This paper concludes that the dominance of Bitcoin also has a significant role in the price movement of altcoins.

1. Introduction

Cryptocurrencies are circulated in the market for a decade now, and they have reached every corner of the Global Financial system due to their instant transmission of value without the mediators of third parties. In the year of 2008, Satoshi Nakamoto invented Bitcoin as a peer-to-peer digital currency with the help of a blockchain system. In later stages, other digital currencies are introduced to the market as Alternative Coins such as Lite coin, Ethereum, Doge, etc., and it is shortly named Altcoins. The Market Price of Bitcoin increased tremendously ($\pm 12000\%$) in the last five years, and its total capitalisation reached \$660Billion^[1]. The innovative features, transparency, and

simplicity led to increasing popularity among traders. The excessive use of Bitcoin for trading in the last couple of years distinguishes the application between the medium of exchange and speculative^[2,3]. The correlation analysis between the return of bitcoin and the return of other financial assets concluded that bitcoin is used as a speculative investment than a medium of exchange^[4]. Many governments and Companies stopped accepting Bitcoin due to the high fees and extreme volatility of bitcoin, and it posed an increased threat to policymakers, entrepreneurs, economists, and consumers^[5]. While Bitcoin did not meet all-purpose, Altcoins are introduced with a different purpose. According to the Cornmarket cap, the total market

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capitalisation of Altcoins reached its peak of 2.5 trillion dollars indicating that Altcoins gained importance in the market and waiting for a breakout.

Despite differences in extreme volatility, the previous studies identified the interdependency of Altcoin with bitcoin and the price mechanism system of cryptocurrency. Due to large Market capitalisation, first in history, and most coins execution systems made Bitcoin dominance in the virtual currency world. The recent study identified 'High liquidity,' 'Dominance,' 'Similar behaviour (Both are digital currencies)' and 'Limited options (As investors first purchase Bitcoin to purchase alternative coins)' are the reasons for the correlation between Bitcoin and Altcoins [6]. The literature exhibited the cointegration in the market eminence of cryptocurrencies [7], and demonstrated cointegration between Bitcoin and other altcoins by using the Johansen Cointegration test, Vector Error Correction Model (VECM) and, Engle-Granger two-step approach [8]. Even though few studies identified a positive correlation between the price movements of Bitcoin and Altcoins, but no studies were conducted to evaluate the interdependencies and price formation of Bitcoin and Altcoins by considering the dominance of Bitcoin in the market [9-11]. Thus, this study helps to identify the relationship between Bitcoin price and Altcoin's price during Bitcoin's High dominance Phase, Moderate dominance, and Low Dominance Phase.

2. Review of Literature

In recent days the bitcoin showed supremacy in the cryptocurrency committee and showed that the acceptability and success of altcoins largely depend on the performance of Bitcoin [12-14]. Until 2019, the investors have to purchase bitcoin to invest in Altcoins, increasing the dominance of Bitcoin in the crypto market. However, it does not clear the reason for increasing the price of Bitcoin and the price relationship between Bitcoin and Altcoins. The increasing popularity of Bitcoin gained not only the attention of Media and Investors but also researchers on the area of Price formation [6,15], portfolio implications [10], [16], blockchain technology [17,18] Market efficiency [19], Asymmetric relationship with Altcoins [7] legal issues [20] and risk-return analysis [21]. According to Crypto & Market survey, Bitcoin demonstrated bubble-like features, and if correlation remained zero with the return of other assets, then there is a significant fall in the value of bitcoin [11]. On the other hand, it affects the recovery of other assets and increases margin call if the investment is made on bitcoin through debt. It is argued that cryptocurrencies do not entirely eliminate fiat currency, and rather if the world accepts digital currency as a medium of exchange, it co-

exists with other currencies [4].

In the early stage of the crypto era, due to the extreme dominant of bitcoin in the market (See Figure 1), the altcoins were unnoticed, but in a recent couple of years, altcoins gained track, especially Ethereum, XRP ADA, and Doge. While analysing the bitcoin dominance and price formation of Altcoins, it showed that Super pumping of Large Altcoins when bitcoin dominance less than 40% and it is the beginning of Altcoin season [9]. Similarly, if dominance above 50% leads to the extinction of Altcoins from the market, and it showed that risk and return spillovers flow from bitcoin to altcoins, i.e., before the bifurcation. However, the direction will be reversed after the bifurcation, and it pointed out that bifurcation significantly weakened the pricing impact and market position of bitcoin in the cryptocurrency market [8,22]. Few studies explored the factors influencing the bitcoin trading volume and investigated the relationship between bitcoin and economic indicators, which finds that, Dow Jones index, WTI oil price euro-dollar exchange rate prognostic influence in elucidation the Bitcoin Price formation in the long run [2,15]. In many circumstances, bitcoin dominance and Altcoin market price showed an inverse relationship. At the same time, the behaviour of Bitcoin on fiat currencies (e.g., USD, Euro) is relative, but the asymmetric relationship with Altcoins is unexplored [23]. The market movement showed that cryptocurrencies are significantly more unpredictably and vary much widespread than fiat currencies [1,24,25]. Since July 2017 crypto market witnessed a boom in ICO (Initial Coin Offerings), and this paradigm decreased the dominance of Bitcoin from 85% to below 45% [26]. As bitcoin lurched with its dominance, it stood at an all-time low by the end of January 2018.



Figure 1. Bitcoin Dominance %

(Source: Trading View, 31.05.2021)

The more evocative disparities that happened during the price formation of altcoins are overstated and converted into a bubble, but later it converted into equilibrium

level in the medium or long term. The level of equilibrium per bitcoin dominance reduced from 80% before 2007 to below 50% in 2021. The dominance of bitcoin stood at 60% during the post-pandemic period, but after Elan Musk tweet about Bitcoin and environmental issues, it fell to below 40%. The bitcoin and altcoins had developed a unique kind of relationship pattern, stated that if Bitcoin price goes up, then altcoin price fell down, and if Bitcoin goes down, then Altcoins goes further down^[27]. Few studies pointed out rising dominance of bitcoin makes reset the support level of Altcoins^[28] and observed progress in the price movement of Altcoins when the dominance of bitcoin is decreased^[29]. The crypto market showed explosive behaviour among cryptocurrencies except for NEM coin, which supported the earlier literature^[5,10,22,30,31].

On the other hand, few studies identified the cointegration among cryptocurrencies by using Johansen and Engle-Granger cointegration tests and found a robust relationship between cryptocurrencies and information transmission by employing Vector Auto-Regression (VAR)^[32-34]. Few studies were carried out to know the relationship between Cryptocurrencies and other financial assets. GARCH model was used to examine the effect of Bitcoin on other variables like Gold, Interest rate, and exchange rate, and the study revealed the similarity of Bitcoin with Gold^[35].

Likewise, Ciaian et al. investigated the relationship between Bitcoin, Stock index, Litecoin, Facebook, Gold, and Google. The study also revealed that online news related to Bitcoin, despite good or bad, reacts quickly and follows efficient market hypothesis, and it also confirmed that vicissitudes in Bitcoin value are due to investors' curiosity by searching queries and information about bitcoin in Wikipedia and Google trends^[36]. This study also demonstrated a bidirectional causality and positive rela-

tion between Bitcoin price and search queries in Google. NRDL approach was used to examine the connectedness of Bitcoin and Altcoins and showed asymmetry in the short run.

Thus, this paper significantly contributes to the results of previous literature, and it additionally increases the knowledge about the connectedness of Bitcoin and altcoins. Uniquely, this study shows the relationship in price formation of Bitcoin and Altcoins in three different Bitcoin dominance phases.

3. Methodology

The dataset consists of daily closing prices for cryptocurrencies that have been in existence for over five years and had a market capitalisation exceeding \$500m as of June 2021. Consequently, our dataset comprises daily figures for Bitcoin and major five altcoins, namely Ripple (XRP), Ethereum (ETH), Doge, Litecoin (LTC), and Namecoin (NMC), from 7th August 2015 (as the earliest date available for Ethereum) to 30th May 2021, resulting in 2065 observations for each cryptocurrency. The prices are listed in US Dollars, and the data are sourced at Yahoo finance^[37]. After collecting data, the researcher segregated the entire data into three groups based on the dominance level. Dominance phase identified with the help of Bitcoin Dominance index^[38], and classification done like (See Figure 1), High Dominance Phase (Dominance ranging from 69.98% to 98.7%) starting from 7th August 2015 to 1st July 2017, Low Dominance Phase (Dominance less than 50%) starting from 1st November 2017 to 1st July 2018 and Moderate Dominance Phase (Dominance ranging between 69.98%-49.98%) commencing from 2nd July 2018 to 30th May 2021. Later all calculations and analyses were made dominance-wise with the help of EViews 10 software.

Table 1. Descriptive Statistics

	BTC*	DOGE*	ETH*	LTC*	NMC*	XRP*
Mean	8.164205	-6.581128	4.506270	3.353480	-0.386847	-2.281761
Median	8.749656	-6.061029	5.232847	3.860461	-0.642167	-1.421350
Maximum	11.02261	-2.540525	7.589476	5.881471	1.992321	1.217228
Minimum	5.349462	-9.079312	-0.832802	0.968177	-1.775315	-5.499210
Std. Dev.	1.389473	1.419715	2.021270	1.420500	0.738377	1.837449
Skewness	-0.410298	-0.059828	-0.933925	-0.501284	0.673734	-0.679386
Kurtosis	2.112073	2.707166	2.908980	1.783454	2.586788	1.812290
Jarque-Bera	125.5314	8.593441	300.3176	213.4101	170.5835	279.6876
Probability	0.000000	0.013613	0.000000	0.000000	0.000000	0.000000
Sum	16826.43	-13563.70	9287.422	6911.522	-797.2920	-4702.709
Sum Sq. Dev.	3977.111	4152.117	8416.199	4156.708	1123.115	6955.008
Observations	2061	2061	2061	2061	2061	2061

In closing prices of cryptocurrencies

4. Data Analysis

Before analysing the inter-relationship between cryptocurrencies, it is important to understand the study's descriptive statistics of considered cryptocurrencies. Table 1 demonstrates descriptive statistics of closing prices (ln values) Bitcoin and selected Altcoins.

Figure 1 helps us to understand the daily price movement of cryptocurrencies for the last five years, and it shows high spikes in all currencies in the previous couple of years. The co-movement of six selected cryptocurrencies from the period of 07.08.2015 to 01.04.2021 is depicted in Figure 2, and the line movement of each currency showed a positive correlation between currencies in the long run. Before employing VEC Granger Causality/Block Exogeneity Test between Bitcoin and Altcoins, it is necessary to check the stationery and cointegration of variables. Table 2 demonstrates the Unit root test result based on Augmented Dickey-Fuller Test, Phillips-Perron test statistic, and Kwiatkowski-Phillips-Schmidt-Shin test statistic. According to Augmented Dickey-Fuller Test and Phillips-Perron test statistic, the null hypothesis is that time-series data are non-stationary, and the alternative hypothesis says stationery. Whereas the Kwiatkowski-Phillips-Schmidt-Shin test indicates, data are stationary in null hypothesis and non-stationary at alternative hypothesis. The test results showed that time series data are stationary at the first difference at 1%, 5%, and 10% significance levels.

The Johansen Co-integration test is employed to check the long-run relationship between six selected cryptocurrencies. The Null hypothesis indicates that variables

are not cointegrated. The result values rejected the null hypothesis at a 5% significance level. The researcher used Akaike Information Criteria by Rank (rows) and Model (columns) to determine the lag interval. The test suggested second lags interval with a minimum value in the fourth column. Therefore, this study concludes that there is a long-run relationship among selected cryptocurrencies.

Table 3. Johansen Co-integration Test Results

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.023203	119.3786	117.7082	0.0390
At most 1	0.016141	71.25251	88.80380	0.4586
At most 2	0.007834	37.89375	63.87610	0.9079
At most 3	0.005848	21.77041	42.91525	0.9191
At most 4	0.003274	9.746205	25.87211	0.9354
At most 5	0.001474	3.023150	12.51798	0.8738

Johansen's cointegration test helps us know that selected cryptocurrencies are cointegrated, and Table 4 helps us identify the correlation of bitcoin with Altcoins. It shows the correlation coefficient between variables chosen in four sections. The first section explains the correlation of currencies in the long run (Full sample), the second section describes the correlation during the High dominance phase, the third section presents the correlation during the moderate dominance phase, and the fourth section explains the correlation during low dominance phase.

Table 2. Unit Root Test results

Test	Cryptocurrencies	At level		First Difference		Conclusion
		Constant	Trend	Constant	Trend	
Augmented Dickey-Fuller Test Equation	BTC	0.0140	4.54	0.0023***	2.73***	D(1)
	ETH	-0.0014	3.26	0.0062**	-2.50*	D(1)
	XRP	-0.0052	3.15	0.0027*	-8.13*	D(1)
	LTC	0.0044	3.31	0.0020**	-9.33**	D(1)
	NMC	-0.0035	1.86	-0.0042**	1.03**	D(1)
	Doge	-0.0223	7.54	0.0048**	2.29**	D(1)
Phillips-Perron test statistic	BTC	0.014*	4.54*	0.0023**	2.73**	D(1)
	ETH	0.0064	3.26	0.0062**	2.50**	D(1)
	XRP	-0.0039	2.43	0.0031*	-1.05*	D(1)
	LTC	0.0044	3.31	0.0020*	-9.33*	D(1)
	NMC	-0.0046	2.16	-0.0004*	9.49**	D(1)
	Doge	-0.0223	7.54	0.0004*	2.29*	D(1)
Kwiatkowski-Phillips-Schmidt-Shin test statistic	BTC	5.9939***	0.0021***	0.002199	3.65	D(1)
	ETH	1.7677***	0.0026***	0.0038	-7.09	D(1)
	XRP	-4.669***	0.0023***	0.0032	-1.12	D(1)
	LTC	1.4708***	0.0018***	0.0018	2.42	D(1)
	NMC	-0.529***	0.0001***	-0.0006	1.09	D(1)
	Doge	-8.58***	0.0019***	0.0003	2.39	D(1)

Note: ***, ** and * indicates null hypothesis rejected at 1%,5%, and 10% significance level and D(1) indicates the first difference.

Table 4. Correlation of BTC with Altcoins in Different Phase

		BTC	LTC	NMC	XRP	DOGE	ETH
Full Sample	Pearson's Correlation	1	.944**	.468**	.903**	.944**	.939**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	2061	2061	2061	2061	2061	2061
High Dominance	Pearson's Correlation	1	.715**	.257**	.596**	.747**	.858**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	664	664	664	664	664	664
Low Dominance	Pearson's Correlation	1	.778**	.888**	.494**	.633**	.601**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	243	243	243	243	243	243
Moderate Dominance	Pearson's Correlation	1	.776**	.188**	.794**	.917**	.218**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	1001	1001	1001	1001	1001	1001

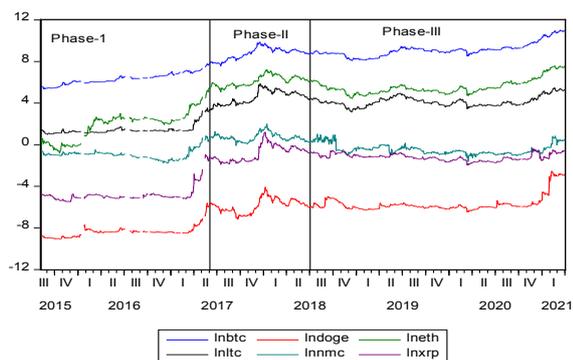


Figure 2. Co-Movement of Cryptocurrencies

The correlation matrix explains that Lite coin ($r=.776$), Ripple ($r=.794$), and Doge coins ($r=.917$) are highly following Bitcoin when the dominance of Bitcoin is moderate, whereas Name coin highly follows the Bitcoin when dominance is low. Ethereum is a good competitor for Bitcoin in the crypto market, and the relation between these two coins ($r=.858$) is high during the high dominance stage. While analysing individual altcoins, Name coin and Ethereum coins have significantly less correlation ($r=.188$) during the moderate dominance phase, and Ripple coin follow less ($r=.494$) during the low dominance phase. Even Figure 2 helps us understand the co-movement of cryptocurrencies in each phase. The correlation results only tell us the relation between variables, but it does not explain the cause. Therefore, it is inaccurate to measure the followness of coins only based on correlation. If coins both have correlation and causation, then we can conclude that there is a significant followness of Altcoins in the dominance of Bitcoins. For this purpose, the VEC Granger causality test was employed for this purpose, and the result is depicted in Table 5.

The Granger (1969) approach to the question of whether 'x' causes 'y' is to see how much of the current 'y' can

be explained by past values of 'y' and then to see whether adding lagged values of 'x' can improve the explanation. 'y' is said to be Granger-caused by 'x' if 'helps in the prediction of 'y', or equivalently if the coefficients on the lagged x's are statistically significant. It is important to note that the statement "x Granger causes y" does not imply that 'y' is the effect or the result of 'x'. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_k y_{t-k} + \beta_1 x_{t-1} + \dots + \beta_q x_{t-q} + e_t \quad (1)$$

Here (1), Y is the price of Altcoin, and x is the price of X. Y_{T-1} is the lag price of Altcoin, and X_{T-1} is the lag price of Bitcoin. Here, the researcher investigated whether the price formation of Altcoin depends on its lag price and lag price of Bitcoin. To answer this research question, a set of hypotheses is developed and tested using the VEC Granger causality test. Table 5 exhibits the test result and decision.

After finding a relationship between bitcoin and altcoins, it is important to know- "Does price movement of Bitcoin influence the price movement of Altcoins." For this purpose, few separate hypotheses are developed and tested using the granger causality test. Results in Table 5 indicate that during high dominance of BTC, it Granger cause XRP and Doge but does not granger cause LTC, NMC, and ETH. During the low dominance of BTC, the price movement of bitcoin Granger cause all of the altcoins. During moderate dominance of the bitcoin, the price movement of Bitcoin does not granger cause LTC, NMC, XRP, and ETH except Doge. From the above analysis, it can conclude that the impact of BTC on altcoins is different depending upon the dominance of Bitcoin in the crypto market. From the above discussion, we understood the nature of the relationship between bitcoin and altcoins,

Table 5. VEC Granger Causality Test

Hypothesis	Dominance Phase	F statistics	Prob	Remark
BTC does not Granger Cause LTC	High Dominance	1.1186	0.2906	Accept
	Low Dominance	13.6088	0.000	Reject
	Moderate Dominance	2.3491	0.1257	Accept
BTC does not Granger Cause NMC	High Dominance	1.86148	0.1731	Accept
	Low Dominance	10.8135	0.001	Reject
	Moderate Dominance	2.0888	0.1488	Accept
BTC does not Granger Cause XRP	High Dominance	3.7734	0.0526	Reject
	Low Dominance	10.788	0.0012	Reject
	Moderate Dominance	1.900	0.1684	Accept
BTC does not Granger Cause DOGE	High Dominance	4.1868	0.0413	Reject
	Low Dominance	9.9137	0.0019	Reject
	Moderate Dominance	6.4129	0.0115	Reject
BTC does not Granger Cause ETH	High Dominance	3.5795	0.0591	Accept
	Low Dominance	9.3766	0.0025	Reject
	Moderate Dominance	3.4774	0.0626	Accept

Table 6. Vector Error Correction Estimates

Phase	Altcoins (Dependent Variables)	Long-run estimates	Short-run estimates	CointEq1	C
High Dominance	LTC	0.53(0.55)	0.09(0.07)	0.0068	-4.76
	NMC	0.44(0.60)	0.14(0.10)	-0.0088	3.70
	XRP	1.16(0.37)	-0.07 (0.11)	-0.0138	12.13
	Doge	2.98 (0.76)	0.083(0.08)	-0.0054	27.13
	ETH	7.84(3.31)	-0.04(0.11)	-0.0018	47.51
Low Dominance	LTC	1.44(0.23)	-0.02(0.11)	-0.074	8.18
	NMC	1.52(0.19)	0.11(0.11)	-0.078	13.08
	XRP	2.23(0.57)	-0.201(0.12)	-0.039	20.86
	Doge	2.09(0.44)	-0.07(0.14)	-0.045	24.63
	ETH	1.43 (0.34)	0.02(0.08)	-0.041	6.62
Moderate Dominance	LTC	0.27(0.15)	-0.06(0.07)	-0.002	-1.71
	NMC	0.62(0.29)	0.025(0.10)	-0.018	6.15
	XRP	0.40(0.21)	-0.08(0.06)	-0.014	4.85
	Doge	2.39 (0.55)	-0.108(0.08)	-0.007	27.60
	ETH	1.09(0.12)	-0.08(0.08)	-0.011	4.36

and in the next section, the researcher identified the extent of relation by using Vector Error correction estimates.

Table 6 indicates the extent of dependence of altcoins on bitcoin in the short run and long run. It identified each phase separately with the error term. It showed that during high dominance of bitcoin, 1% increase in BTC price, increases 0.53% in LTC and increases 0.44% in NMC, increases 1.16% and 2.98% in XRP and Doge respectively. In the high dominance phase, in the long run, altcoins moved highly positive ($\beta > 1$) to the BTC, but in the short run, altcoins drove relatively positive ($\beta < 1$, but $\beta > 0$) to the price of BTC. In the low dominance phase, for 1% change in the BTC price, changes 1.44% in LTC, 1.52% in NMC, 2.23% in XRP, 2.09% in Doge, and 1.43% in ETH in the long run. But in the short run, all altcoins except NMC moves relatively negative ($\beta < -1$). During the moderate dominance phase, 1% increase in BTC price, increases 2.39% in Doge and 1.09% in ETH. While considering other altcoins (LTC, NMC, and XRP), the changes are half of the BTC price changes. Likewise, in all other dominance

phases, altcoins moved negatively to the movement of BTC in the short run.

Price Estimation Equation

After understanding the nature and extent of the relationship between Bitcoin and altcoins, it is possible to develop an equation (Vector Error Correction Model). This equation helps readers and investors predict the price of altcoins based on the price movement of Bitcoin in different dominance phases.

During High Dominance:

$$\text{DOGE} = -0.005468 * \text{DOGE} (-1) - 2.98 * \text{BTC} (1) - 27.1283245511 + 0.00899 * \text{DOGE} (1) + 0.08019 * \text{BTC} (-1) + 0.001731$$

$$\text{ETH} = -0.001795 * \text{ETH} (-1) - 7.84 * \text{BTC} (-1) + 47.51 + 0.10217 * \text{ETH} (1) - 0.036203 * \text{BTC} (-1) + 0.008869$$

$$\text{LTC} = 0.00835 * \text{LTC} (-1) + 0.26 * \text{BTC} (-1) - 3.10 + 0.0190 * \text{LTC} (-1) - 0.0587$$

$$\text{NMC} = -0.008394 * \text{NMC} (-1) - 0.44 * \text{BTC} (-1) +$$

$$3.699 + 0.0047 * \text{NMC} (-1) + 0.1335 * \text{BTC} (-1) + 0.0003 \\ \text{XRP} = -0.0139 * \text{XRP} (-1) - 1.17 * \text{BTC} (-1) + 12.14 + \\ -0.17389 * \text{XRP} (-1) + 0.077934 * \text{BTC} (-1) + 0.002419$$

During Moderate Dominance:

$$\text{DOGE} = -0.007390 * \text{DOGE} (-1) - 2.39 * \text{BTC} (-1) \\ + 27.59 + -0.0002 * \text{DOGE} (-1) + -0.1074 * \text{BTC} (-1) + \\ 0.003566$$

$$\text{ETH} = -0.0105 * \text{ETH} (-1) - 1.09 * \text{BTC} (-1) + 4.37 + \\ -0.0142 * \text{ETH} (-1) + -0.0756 * \text{BTC} (-1) + 0.0008$$

$$\text{LTC} = -0.005 * \text{LTC} (-1) - 0.28 * \text{BTC} (-1) - 1.54 + \\ -0.022 * \text{LTC} (-1) + -0.05 * \text{LTC} (-2) + -0.04 * \text{BTC} (-1) + \\ 0.116 * \text{BTC} (-2) + 0.0001$$

$$\text{NMC} = -0.018 * \text{NMC} (-1) - 0.62 * \text{BTC} (-1) + \\ 6.14386267478) + -0.181 * \text{NMC} (-1) + 0.028 * \text{BTC} (-1) + \\ -0.002$$

$$\text{XRP} = -0.0139 * \text{XRP} (-1) - 0.400 * \text{BTC} (-1) + 4.85 + \\ -0.173 * \text{XRP} (-1) + -0.078 * \text{BTC} (-1) + 0.002$$

During Low Dominance:

$$\text{DOGE} = -0.0447 * \text{DOGE} (-1) - 2.087 * \text{BTC} (-1) + \\ 24.63 + -0.0289 * \text{DOGE} (-1) + -0.082 * \text{BTC} (-1) + 0.0005$$

$$\text{ETH} = -0.0737 * \text{ETH} (-1) - 1.43 * \text{BTC} (-1) + 6.62 + \\ 0.002 * \text{ETH} (-1) - 0.002 * \text{BTC} (-1) + 0.0007$$

$$\text{LTC} = -0.018 * \text{LTC} (-1) - 1.44 * \text{BTC} (-1) + 8.18 + \\ -0.181 * \text{LTC} (-1) + 0.028 * \text{BTC} (-1) + -0.0022$$

$$\text{NMC} = -0.078 * \text{NMC} (-1) - 1.52 * \text{BTC} (-1) + 13.08 + \\ -0.0884 * \text{NMC} (-1) + 0.1082 * \text{BTC} (-1) - 0.0008$$

$$\text{XRP} = -0.0389 * \text{XRP} (-1) - 2.23 * \text{BTC} (-1) + 20.858 + \\ 0.0554 * \text{XRP} (-1) + -0.2014 * \text{BTC} (-1) + 0.00154$$

The above equations help investors predict altcoin prices depending upon the price movement and level dominance of bitcoin. Where (1) indicates the current market price and (-1) indicates the previous day's price. Likewise, (-2), (-3) indicate past prices of bitcoin and altcoins. For example, In the first equation; $\text{DOGE} = -0.005468 * \text{DOGE} (-1) + 2.98 * \text{BTC} (1) + 27.13 + 0.00899 * \text{DOGE} (1) + 0.08019 * \text{BTC} (-1) + 0.001731$, where future price of doge can be estimated by using this equation like, $-0.005468 * (\text{previous day closing price of Doge in Natural log}) + 2.98 (\text{current market price of BTC in natural log}) + 27.13 + 0.0089 * (\text{current market price of Doge in natural log}) + 0.08019 * (\text{previous day price of BTC in natural log}) + 0.001731$ (error correction term)

5. Conclusions

This paper aims to study both the long- and short-run followness of major altcoins like Ethereum, Doge, XRP, NMC, and LTC to the price movement of Bitcoin by using the VEC model. The Johansen cointegration test result proved cointegration between Bitcoin and altcoins. The Pearson's correlation coefficients provide evidence of a positive and statistically significant correlation between

Bitcoin price movement and altcoins, but the extents of the relationship are greatest during moderate dominance and low during the low dominance phase. Moreover, the cointegration equation reveals that cryptocurrency returns usually respond similarly to positive and negative changes in Bitcoin returns, with very few exceptions. Furthermore, our tests indicate that asymmetries in the long-run impact of Bitcoin returns are operative on a maximum of only two of nine cryptocurrency returns, but there is strong evidence of asymmetry in the short-run effect of Bitcoin returns in all cryptocurrency returns for all frequencies. While comparing all other altcoins, the Dogecoin moves differently for the movement of Bitcoin. According to the study results, some cryptocurrencies (in concrete XRP and LTC) are more connected to Bitcoin than others. Thus, potential practical applications of our results could be that the least connected virtual coin can be used to diversify positions in Bitcoin, whereas the more connected the Altcoin is, the better it can be used to hedge positions in Bitcoin. Finally, the study concludes that the price movement of Bitcoin significantly influences the price movement of altcoins and the extent of influence high during moderate dominance and low during low dominance phase.

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